BUSINESS MODEL INNOVATION

Unlocking the next chapter of building through a platform ecosystem model

Building 4.0 CRC Project #40

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

"While we have known for quite some time that the building industry has been underperforming and desperately needs to innovate, what is new in this project is the focus on business models and a reformed value chain as a means of unlocking innovation in building."

- Prof. Mathew Aitchison, Building 4.0 CRC

OVERVIEW

The transition towards a platform approach is emerging as a compelling alternative that could instigate a new industry evolution and generate a virtuous cycle for all stakeholders involved. To better understand this opportunity, Building 4.0 CRC conducted business model innovation workshops with industry stakeholders across four Australian cities—Adelaide, Sydney, Melbourne, and Brisbane from November 2022 to May 2023. Through these one-of-a-kind workshops, concrete data was gathered for the first time on how participants in the industry perceive such issues as business model innovation; changes to the structure of the building value chain; the positioning of their existing businesses within the value chain; and, operating models and the adaptations required to embrace new ways of working. This data provides a foundation for informed decision-making and strategic planning in the building industry. While prefab, modular, offsite, MMC, and industrialised building are often regarded as focal points for industry innovation, it became evident that the industry needs to recognise there are other opportunities for innovation and alternative viewpoints beyond the narrow "prefab, good or bad" lens.

THE PROBLEM

The current building system predominantly adopts a pipeline model, which is inherently fragmented, resulting in extremely low-profit margins and a limited market capacity. Stagnant productivity is echoed in the variable building quality, escalating costs, and a slow and unpredictable speed of execution. The project-to-project learning is limited, leading to a low level of innovation. Adopting platforms and platform business models, on the other hand, can lead the industry towards the virtuous cycle mentioned above, and greatly accelerate the uptake of product platforms.
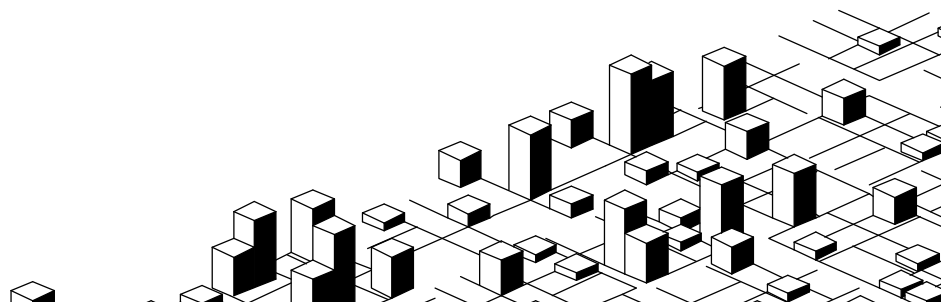
TRADITIONAL INDUSTRY STRUCTURE

Financiers
Developers/Construction companies
Consultants
Builders
Tradespeople
Wholesale Supply
Distributors
Manufacturers
Materials

SUPPLY CHAIN

X

MARGINS

+

Y

MARGINS

=

EXPENSIVE
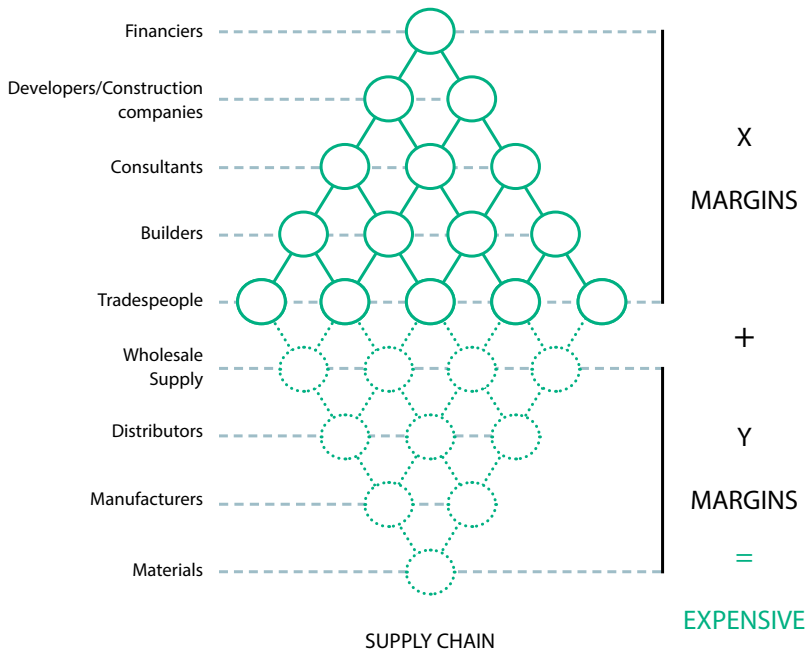
The current industry structure is a large part of the problem with the industry. It operates project to project, on low margins, with a margin-on-margin approach largely due to the deep fragmentation and subcontracting model.

PLATFORM BUSINESS MODEL

Kitchen Fabricator
Structural System
Joinery
Assembly Crew
Design
Finance
Engineering
Land
Consultant #1
Marketing
Consultant #2
Interface

PLATFORM ECOSYSTEM

End-User
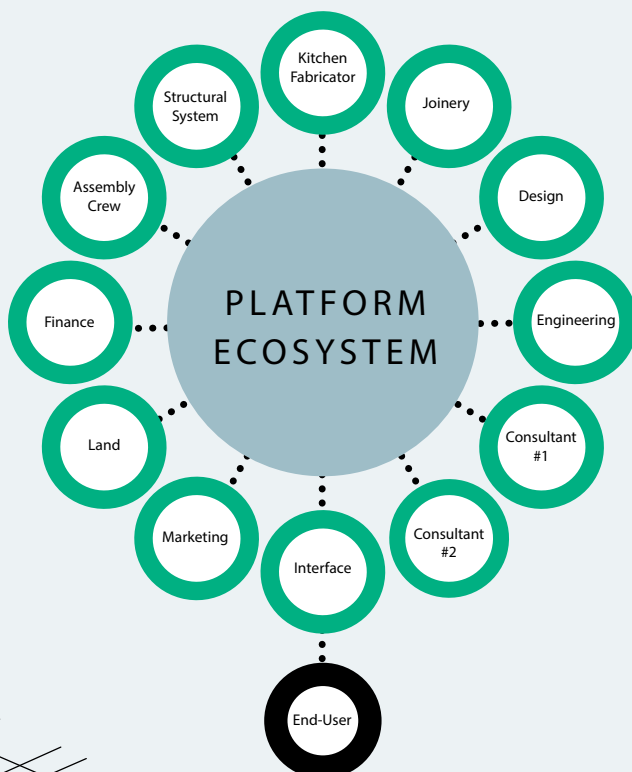
Within a platform business model, each part of the value chain interacts with the platform owner. This leads to disintermediation, and allows for a 'capital lite' approach to growing industry capacity.

APPROACH

This report focuses on presenting the platform ecosystem business model as a conversation starter in the larger discussion around business model innovation in the building industry. The report commences by illustrating the benefits of the model and how it can be implemented through contemporary global publications on platforms. The following section presents case studies of six global platform companies.

NT

QLD

114

WA

SA

NSW

74 95

VIC

136
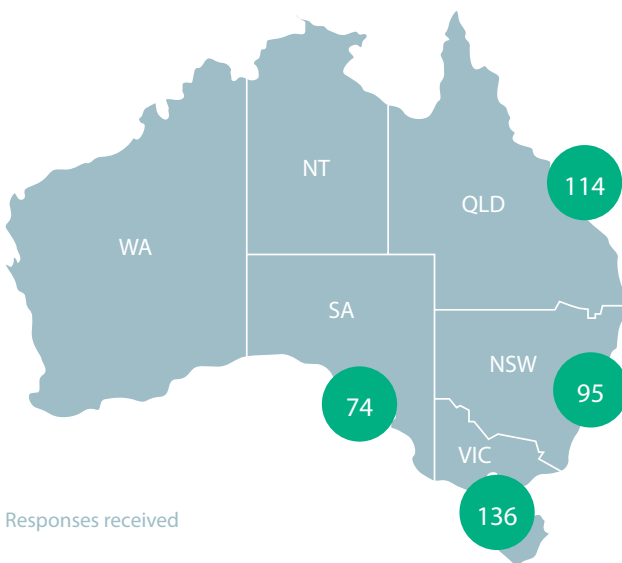
Responses received

Workshops were conducted in four Australian cities—Adelaide, Melbourne, Sydney, and Brisbane—with participation from all stakeholders in the building value chain, including architects, engineers, consultants, contractors, governmental bodies, digital platform providers, and client body representatives. The cumulative participant count for the workshops was around 90 people. The workshop insights in terms of the opportunities and challenges of the model and key changes required from the stakeholders are also presented in the report. Finally, the report evaluates how ready the Australian building ecosystem is to implement such a model and concludes with recommendations for the government, industry, peak industry bodies, and academic institutions.

16%	72%	12%
Government Representatives	Industry Executives	Researchers

WORKSHOP INSIGHTS

- Adopting a 'platform approach' is not a one-size-fits-all solution but rather a versatile model that can be tailored to fit varying circumstances and organisational needs. The possibilities range from internal to external-facing models (product platforms to platform ecosystem models). This diversification allows organisations the flexibility to deploy the most fitting approach, thus laying the groundwork for a sustainable and efficient industry transformation.

- Who are the drivers of change? Who should be the leading force of change in Australia: government or private sector? The UK emphasises government strategy, while the USA relies on venture capital influence. The UK's Forge initiative suggests a hybrid approach.

- A discernible willingness was observed from both the government and industry to explore new options when presented with global case studies such as Intelligent City, Bryden Wood, and Nabr.

The workshop responses illustrated exemplars of integration, servitisation, and expertisation, the three super-patterns of business model innovation in Industry 4.0, which will be elaborated on in the report.

TOP 5 RECOMMENDATIONS FOR KEY SECTORS

GOVERNMENT

- Prioritise innovation
- Develop cooperative contractural frameworks
- Establish productivity measures
- Expand the reconstruction fund
- Create financial resilience

RESEARCH & EDUCATION

- Integrate 'prefab' into the curriculum
- Fundraise for demonstration projects
- Focus research on cooperative contractual frameworks
- Explore platforms and digital twins
- Evaluate a platform-led human-centric approach

INDUSTRY

- Create an ecosystem
- Build digital and procedural capacity
- Invest in research & development
- Integrate platform DNA
- Upskill through digital literacy training

PEAK INDUSTRY BODIES

- Develop inclusive industry action plans
- Establish annual review of such action plans
- Develop product-process accreditation systems
- Focus advocacy on the process and less on the product
- Gather relevant data
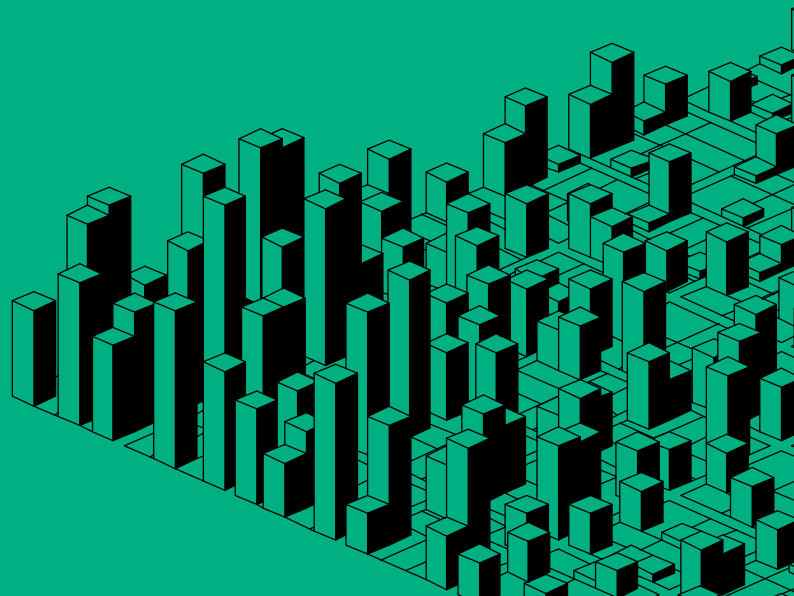
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BACKGROUND

PRODUCT PLATFORMS

Product design was traditionally viewed as a singular, isolated activity in manufacturing. According to Meyer and Lehnerd (1997), this traditional approach understated the potential for "commonality, compatibility, standardisation, or modularisation among different products and product lines." Manufacturers developed product platforms to create simple product lines that could share elements of a common family structure in response to this challenge. Utilising a product platform allows for the efficient development of differentiated products by sharing physical components and production processes (Maxwell, 2018). The earliest definitions of product platforms were "… the collection of assets that are shared by a set of products" (Robertson and Ulrich, 1998) and "…a set of common components, modules, or parts from which a stream of derivative products can be efficiently created and launched" (Meyer and Lehnerd, 1997).

Sweden and Japan are two of the world's leading producers of industrially built housing. The sector's steady development in Japan resulted from "a combination of continuous incremental and disruptive innovations and a unique socio-economic and socio-cultural environment" (Höök, 2008). Swedish success stories in literature always start with Boklok, where Swedish multinational contractor Skanska collaborated with IKEA to develop a low-cost housing delivery system using a product platform aimed at critical workers with restricted wages. Using the IKEA brand, Boklok established a strong and consistent market identity that aims to serve the general public with high-quality, well-designed housing.

Product platforms have established an approach to building that can be ascribed as a way of platform-thinking. Such an approach to building manifests in ways that complement and drive forward product platforms and have been defined in research by Building 4.0 CRC's Project #3 as emerging in digital platforms, platform ecosystems, and hybrid architectures.

DIGITAL PLATFORMS

Many digital solutions have existed in the building industry for more than a decade in the form of point solutions that address fundamental requirements, such as enhancing design capabilities or digitising paper-based data. With increased adoption, interoperability between the point solutions became a problem that propelled the solution providers to expand their product portfolios and create suites of integrated solutions. This trend is expected to continue with the industry moving towards digital platforms even though plenty of point solutions or integrated suites will still exist.

Digital platforms, therefore, are 'online intermediaries' that act as facilitators of value exchange through information flow. They are 'people-centred', wherein the supply chain actors play an important role in the exchange of value.

HYBRID ARCHITECTURES

Sandberg et al. (2019) stated that during the last decades, a new set of industrial products have emerged where physical and digital components (and associated functionalities) are increasingly integrated. They defined 'hybrid platforms' as the intermingling of modular physical components with digital functionality to increase their variability and evolvability. Sandberg et al. (2019) further explained that in such platforms, states of the physical world are continuously mapped to digital representations (using sensors embedded in physical components) then the world is operated and controlled through a set of actuators (digital to analogue converters).

The verdict is that the future of platforms will witness more hybrid business models; the underlying driver of this trend is digital competition, where companies will grow rapidly with a "clever combination of data, software, and ecosystem strategies" (Cusumano et al., 2020).

PLATFORM ECOSYSTEMS

The platform as a concept is evolving in current applications; there has been a shift from viewing platforms as purely internal company structures, as was the case of product platforms, to consider them on a more industry-wide scale (Maxwell, 2018). Such an integrative framework was seen in the work of Gawer (2014), where platforms are classified into internal, supply chain, and industry platforms.

Industry platforms are managed through governance mechanisms (which sometimes can be pricing) and have open interfaces that allow sharing specifications with complementors.

Platform Innovation and Competition (Gawer, 2014)

CONTEMPORARY WORKS IN THE PRODUCT PLATFORM SPACE

The Product Platform Rulebook and its derivative works established a stepwise method of building a product platform strategy and then evaluating the resulting product platform. Building a project platform strategy involves:

- establishing the client's product portfolio, which is the range of buildings the client delivers

- understanding the product pipeline, which is the likely demand for these products (buildings)

- with an understanding of the above, breaking down each product (building) into its constituent components in terms of product breakdown structures to produce product architectures

- dissecting each product in the product portfolio into its constituent elements to quantify the aggregated demand (across products /buildings)

- conducting value analysis on the constituent elements to identify those that substantially impact value

- undertaking a commonality assessment to understand the extent to which requirements vary across products (buildings) in the portfolio

- testing processes.

Several UK case studies helped to establish certain rules and principles to evaluate product platforms. The Product Platform Rulebook says product platforms must be deployable across multiple, non-identical assets yet configurable to suit individual project requirements and comprise common repeatable elements including (a kit of parts, knowledge, people and relationships). Further, the product platform shall be defined as interfaced, enabling any party to make, use and, buy common, repeatable elements. Beyond this, product platforms will abide by three principles: have a defined quality standard, have a structured approach to information and enable a degree of circularity.

CONTEMPORARY WORKS IN THE INDUSTRIALISATION & DIGITALISATION SPACE

McKinsey and Company, in their much-publicised report, 'Rise of the Platform Era: The next chapter in construction technology' stated that digital platform solutions might

(a) cater to specific industry subsegments or value providers for example "a platform solution targeting the bulk-materials supply chain and producers operating in that space", or

(b) enable broader connection in the built environment with the integration of design, project management, and scheduling tools to unlock the value of a truly end-to-end digital delivery or

(c) build a data-analytics engine leveraging the growing pool of inter- and intra-company data.

The Joint Center for Housing Studies Harvard University nests digitalisation and technology within three other frames: the contextual frame (i.e., market, material, labour, regulations, and culture), the business platform frame (value creation, supply chain, and integration), and the product platform frame (modularisation, product platforms, assemblies, and continual improvement).

Through case studies, this report demonstrates that

"investment in the digital and mechanical technologies alone, without the implementation of platform thinking, will not result in increased housing affordability. In fact, quite the opposite is likely to occur where capital-intensive investments can increase costs compared to conventional construction."
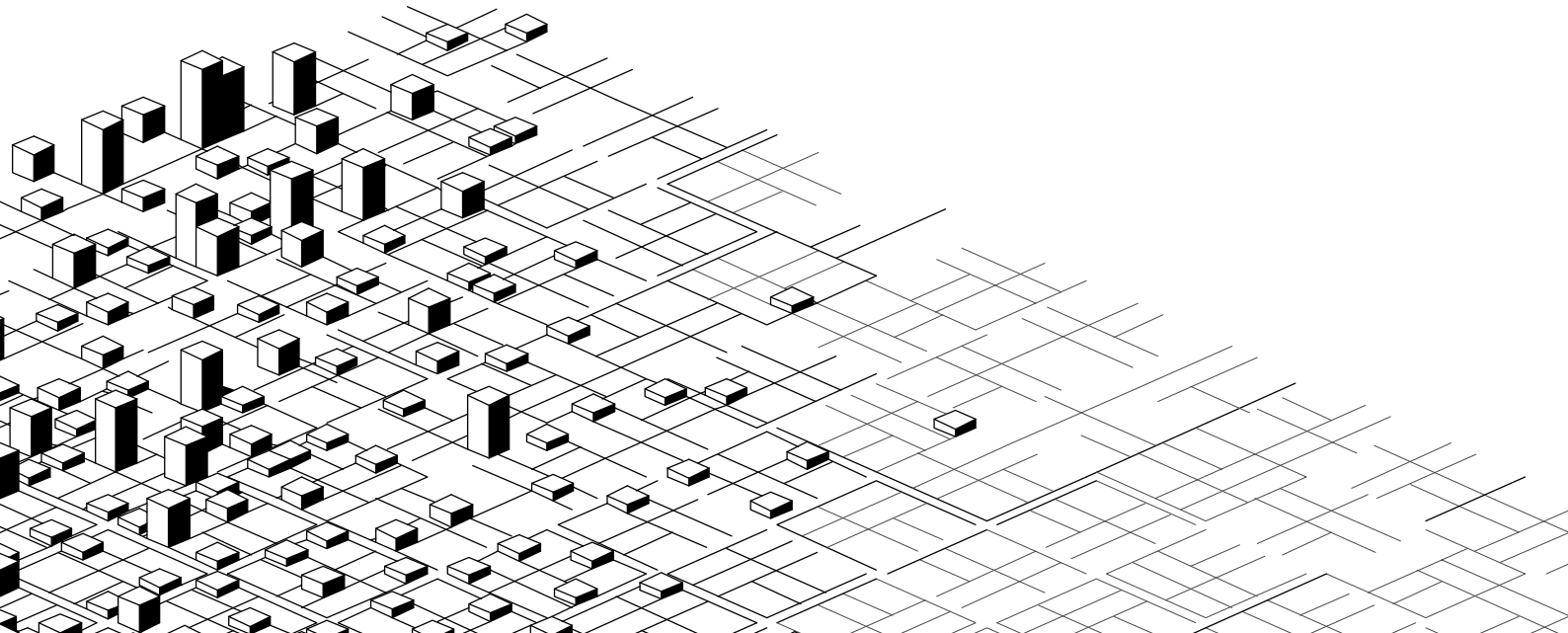
INDUSTRIALISED - DIGITALISED BUSINESS MODELS

Weking et al. (2020) investigated 32 case studies of Industry 4.0 business model innovation and identified that integration, servitisation and expertisation are the three super-patterns of business model innovation in Industry 4.0:

- integration attempts to integrate parts of the supply chain through new processes, whereas new combined products and services are the basis for servitisation, and

- expertisation is a hybrid approach that utilises product and process focused business models, including consulting services and multi-sided platforms.

The different mechanisms for value creation, offer, and capture in Industry 4.0 business models were assimilated from the literature and presented in Table 1.

VALUE CREATION	VALUE OFFER	VALUE CAPTURE
Customisation – mass production, mass customisation, mass individualisation	Products – Physical only, physically, digitally charged, digital-only	Market – B2B only, B2C only, B2B and B2C, multi-sided market
Role of a value chain firm – integrator, service and support, intermediary	Service – Repair and maintenance, monitoring and predictive maintenance, production, technology, advice and consulting, digitalisation services, data analytics services, virtual product development	Segmentation – based on customer knowledge and data analysis
Factory – mega factory, micro-factory		Customer interaction – hybrid (direct and intermediary), direct selling leading to long-term relationships
Production paradigm – pull / on-demand, push and pull		Revenue model – sales, revenue sharing, freemium, rent/lease, subscription, pay-per-use, pay-per-feature
Partners – higher intercompany connectivity, co-design of value offers, joint data analysis, higher information transparency		Sales model – ownership/service delivery, use/availability, result
Information exchange – real-time information about production, inventories, sales, availability of personnel, etc.		Payment methods – digital accounting and automated invoices, increased payment reliability
		Cost – potential for cost reduction for all stakeholders due to the most efficient processes and information sharing

Table 1: Value Creation, offer and capture mechanisms in Industry 4.0

CASE STUDIES

A range of global platform companies in building were identified based on Gawer (2014) platforms classification. They represent different platform approaches – physical, digital, and hybrid – that operate at an internal, supply chain, or industry level.

- Physical
- Product Platforms
- Internal Level

- Physical / Digital
- Product / Ecosystem Platforms
- Supply Chain Level

- Digital
- Platform Ecosystem
- Industry Level

A spectrum of platform companies

THE INTEGRATED PRODUCT PERSPECTIVE

INTELLIGENT CITY

Intelligent City is a technology-driven company that offers seamless and transparent design to delivery of mass timber housing solutions. They started as an architect and planner and then expanded their value chain to include manufacturing and automated assembly. Intelligent City was founded to create highly integrated and generative mixed-use housing systems combining high-quality liveability, enhanced affordability, advanced sustainability, and community engagement into one consistent, replicable, and adaptable solution. They bring to the market a perspective of 'Integrated Product'. To date, Intelligent City raised $30 million to advance the sustainable urban housing industry using mass timber, automation, and robotics. "Infinitely configurable and customisable, their software can run through hundreds of iterations to find the optimal balance between regulations, design intent, and cost." Intelligent City's approach is centrally controlled, and exchange of data is restricted within the company.

Image: Intelligent City opened their first robotic urban housing factory in Vancouver (October 2021)

THE DISTRIBUTED PROJECT PERSPECTIVE

BRYDEN WOOD

Bryden Wood is a global consultant to the platform approach. They have been involved in P-DfMA (Platform - Design for Manufacture and Assembly) projects with major contractors. Their project, 'the Forge' which was completed in 2021-22, has been discussed by platform enthusiasts globally and is an ultimate example of the 'platform ecosystem business model'. Bryden Wood brings to the market a perspective of 'Distributed Project'. At Bryden Wood, the platform approach emerged from rigorous research across several projects since 1995, enabled by strategic partnerships with the government, academia, and the industry. In the Bryden Wood model, commonality is not only in the components or modules; it is also in the processes, enablers, and equipment. All these elements are encapsulated in the platform rules, not just production standpoints.

Bryden Wood has defined various platform types based on their clear height and clear span. A single component could be used as a part of a school, hospital, prison building or station, or commercial office. The platform system becomes the carrier frame for architecture, and fabrication is standardised. The structural complexity is transferred to the connections. The platform system also becomes a carrier frame for complementary systems (such as mechanical, electrical and plumbing or MEP); in fact, it is an open system to collaborate on.

PLATFORM 0	• Low-cost, rapid assembly temporary or permanent accommodation (multi occupancy rooms to family apartments) • Disaster relief / displaced populations / large scale construction camps
PLATFORM 1	• Cellular accommodation, single occupancy rooms • Single living accommodation, secure accommodation, student rooms etc.
PLATFORM 2	• Mid span (up to 8m) multi sector use • Education, healthcase apartments, offices, etc.
PLATFORM 3	• Office planning grid (9m x 9/10.5/12m) • Commercial/high-end residential, etc.
PLATFORM 4	• Long span (up to 36m) • Logistics centres/distribution/warehouses etc.

Table 2: Bryden Wood platform offerings

THE COMPLETE 'PLATFORMISATION' PERSPECTIVE

KATERRA

Katerra was a construction technology company that aimed to optimise every aspect of building design, materials supply, and construction. Experts, professionals, and researchers in the transforming construction space watched with keen interest as a startup raised more than $2 billion dollars in an attempt to vertically integrate the construction supply chain.

The founders had experience with Tesla and Autodesk which felt like a perfect marriage of physical and digital platform knowledge. However, due to insufficient verification of their business model and a lack of deep sectoral knowledge, the company had faced significant challenges, including leadership changes, layoffs, and financial issues, which led to it filing bankrupcy in June 2021.

Katerra was attempting to go beyond physical platforms towards an integrative framework of platform ecosystems. Their approach mimicked the market dominance path that the tech sector's Big 5 take; their fall raised questions about whether partnering might be a better strategy in building than dominance.
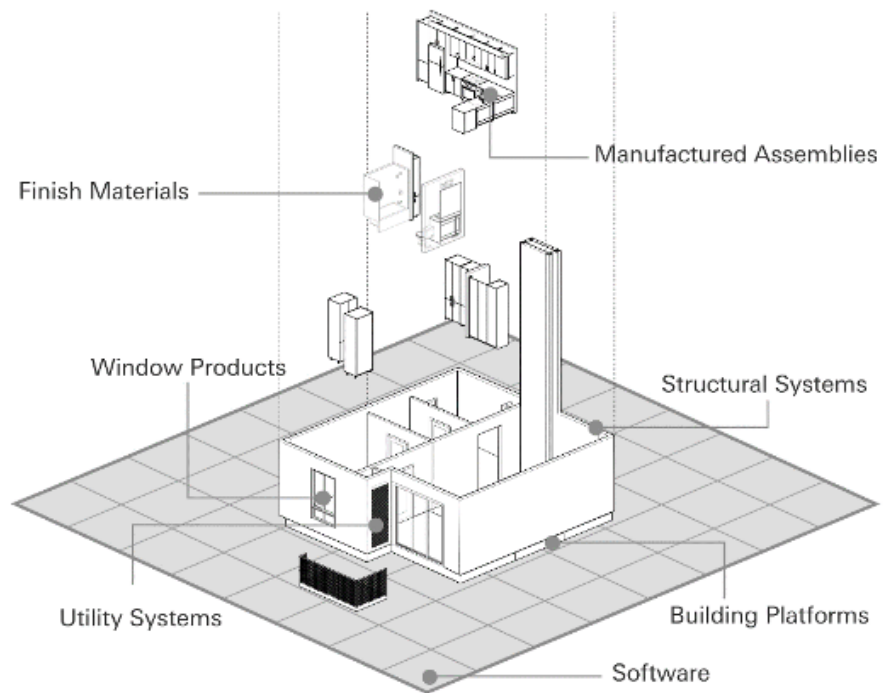
Image: Katerra design vision

THE INDUSTRIALISED CONSTRUCTION CONSULTANT PERSPECTIVE

PROJECT FROG

Project Frog is streamlining design and construction processes with a scalable digital platform that can be inserted anywhere along the build process. Project Frog offers a holistic approach to productising buildings from design to occupancy using their digital platform.

Their value proposition includes 'Project Frog Fit', a predictable and repeatable building program that captures the speed of offsite construction while ensuring brand compliance and 'Project Frog Flex', a standardised kit of parts. Additionally, they offer KitConnect, an integrated Revit to web application that manages a configurable, modular content library (kit-of-parts content) and is available as a plugin for the Autodesk Construction Cloud. Project Frog brings to the market the concept of a 'digital systems integrator'.

THE MARKETPLACE PERSPECTIVE

PT BLINK

Originating in Sydney, Australia, PT Blink offers a patented structural technology and digital platform that enable the parametric design, offsite manufacture, and onsite integration of multi-storey buildings as a kit of configurable components. Called Blink DMI® for its ability to slash project time by 40-60%, the methodology enables direct dealing between buyers and sellers for manufactured components. Uniquely, PT Blink merges the digital and physical worlds with its post-tensioned steel Blink Backbone® providing the precise datum for the structure that integrates manufactured components using the proprietary Blink DMI® Cube interface. The platform is open to accredited Blink DMI® partners to maximise design and structural options, achieve scale and geographic distribution, and enable manufacturers to register and earn from their own intellectual property. PT Blink attracted a $5 million investment from the owners of US-based multibillion-dollar real estate investment company Holland Partner Group in 2021. PT Blink currently licenses its technology on a project basis and is preparing to launch the platform as a Software as a Service offering, including access to a parametric design tool and marketplace for manufactured building components.

THE SIMPLIFIED HOMEOWNERSHIP PERSPECTIVE

NABR

Co-founded by Bjarke Ingels (founder of architectural firm Bjarke Ingels Group), Roni Bahar (formerly of WeWork), and Nick Chim (co-founder of Flux, a spinout of Google[x]), Nabr launched to the public in December 2021. Yet to be tested, Nabr brings to the market a 'Simplified Homeownership' perspective with their 6-steps to moving in model.

Buyers always have a direct point of contact rendering the home-buying process straightforward. All homes begin with the Nabr design. Buyers can browse curated design packages and upgrades to make their space feel personal. The company is attempting to create added value through regulatory and financial service and support which generally does not come as an integrated offering with housing.
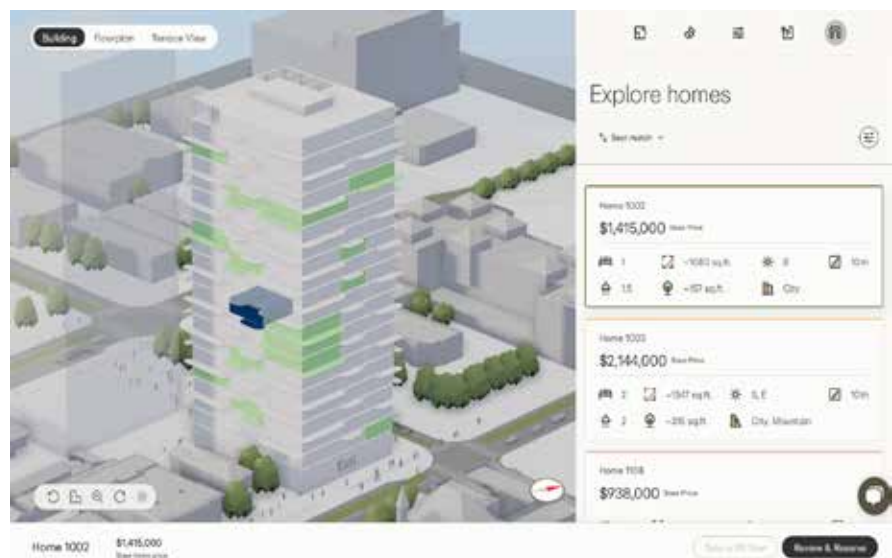

Image: The Nabr Platform

SUPER-PATTERNS IN BUSINESS MODEL INNOVATION CASE STUDIES

INTEGRATION

Intelligent City and Katerra align with the 'integration' super-pattern. Their value proposition is a one stop shop where clients get a fully resolved, pre-engineered, high-quality product that doesn't cost more than the typical building and is also customisable so clients can identify themselves with it. The operating value chain is a function of where the appetite is and what makes sense for the business, but their building systems ensure vertical integration is possible. Table 3 illustrates how companies that align with the integration super-pattern create, offer, and capture value.

EXPERTISATION

Bryden Wood and PT Blink align with the 'expertisation' super-pattern which is a hybrid approach that utilises product and process focused business models including consulting services and marketplaces. As mentioned above, Bryden Wood encapsulated common processes, enablers, and equipment in 'platform rules' and the platform system becomes the carrier frame for architecture and fabrication. This has been developed through years of research and experience in modern methods of construction. Table 3 illustrates how companies with an expertisation super-pattern create, offer, and capture value.

SERVITISATION

Digital platforms like Project Frog and Nabr serve as catalysts for inter-organisational cooperation and enable industrial firms to co-create value. Nabr's combined products and services offering clearly aligns with the 'servitisation' super-pattern. It is also the only 'business-to-customer' business model which requires new capabilities in learning more about their customers and their value creation process utilising digital means. Table 3 illustrates how companies with the 'servitisation' super-pattern create, offer, and capture value.

"The delivery model evolved from traditional construction, traditional with repeatable design elements, volumetric modular, platforms / systemised build through to automated construction while the digital tools evolved from 2D CAD, BIM, parametric design, algorithmic design through to generative design. "

- Bryden Wood

BENCHMARKING THE CASE STUDY COMPANIES

	VALUE CREATION	VALUE OFFER	VALUE CAPTURE
INTEGRATION (Intelligent City, KATERRA)	• Mass customisation • Playing the role of integrator • Factory • Real time information about production, inventories, sales, availability of personnel, etc.	• Product - Physically, digitally charged • Service – Technology, advice & consulting, digitalisation services, data analytics services, virtual product development	• Revenue model – Sales (current), licensing (potential) • Cost – Potential for cost reduction for all stakeholders due to most efficient processes and information sharing
EXPERTISATION (Bryden Wood, ptblink)	• Higher intercompany connectivity • Co-design of value offers • Joint data analysis • Higher information transparency	• Product - Digital products • Service – Advice & consulting, digitalisation services, data analytics services	• Segmentation – Based on customer knowledge and data analysis • Revenue model – Sales (advisory fee), long-term relationships • Cost – Potential for cost reduction for all stakeholders due to most efficient processes and information sharing
SERVITISATION (projectfrog, nabr)	• Mass customisation • Service and support (Regulatory, Financial - Lease to Purchase)	• Products – Physically, digitally charged • Service – Repair & maintenance, monitoring and predictive maintenance, virtual product development	• Revenue model – B2C sales, subscription, pay-per-use, pay-per-feature • Cost – Potential for cost reduction for all stakeholders due to most efficient processes and information sharing

Table 3: Value creation, offer and capture mechanisms in the case study companies

WORKSHOP INSIGHTS

OPPORTUNITIES

COLLABORATION AND LEARNING FROM OTHER PROJECT STAKEHOLDERS

Collaboration and learning from all project stakeholders at every stage of the value chain emerged as significant in driving the platform approach, emphasising the importance of fostering a cooperative environment that encourages knowledge exchange and continuous improvement throughout the building process.

DATA AND INFORMATION TRANSPARENCY ACROSS VALUE CHAIN

Efficient and interoperable data management and information transparency across the value chain are critical factors for success, underscoring the need for streamlined communication and accessible data sharing.

DIRECT SUPPLY CHAIN ENGAGEMENT AND BUSINESS AT SCALE

Direct supply chain engagement and planning at scale highlight the need for close collaboration and coordination among stakeholders to optimise project outcomes.

EARLY INVOLVEMENT TO INFLUENCE THE DESIGN

Early involvement is vital to influence wider design objectives, emphasising the significance of considering multiple perspectives and integrating stakeholder input from the outset.

"I am an architect, and I can participate in more elements of the ecosystem (through ownership and service delivery)."

"I am a prefab manufacturer, and I need to be involved at a design level as early as possible in a project lifecycle to provide constructability input."

Opportunites

- Collaboration and learning from other project stakeholders — 33.3%
- Data and information transparency across value chain — 23.61%
- Early involvement to influence the design — 20.14%
- Direct supply chain engagement and business at scale — 22.92%
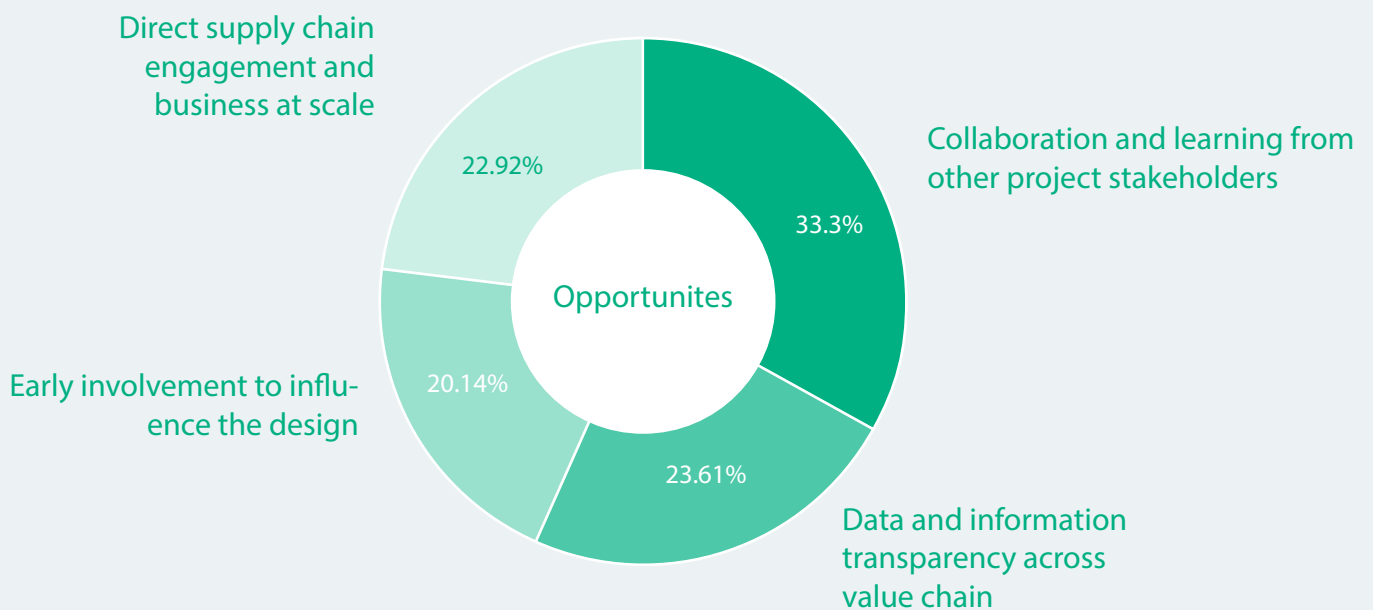
OTHER ASSOCIATED DRIVERS

- Visibility of the pipeline of work is a crucial aspect that platforms can provide, enabling better planning, resource allocation, and forecasting for all stakeholders involved. The workshops also underscored the potential for demand harmonisation through platforms.

- Improved efficiency is a significant advantage of platform-based approaches, as they can streamline processes, reduce rework, and enhance overall productivity.

- Shortened design timeframes are a positive outcome of platform-based approaches, allowing for faster project delivery and reducing time-to-market.

- The use of platforms also opens up new marketing opportunities, enabling businesses to reach wider audiences and promote their services more effectively.

- The ability to decarbonise the supply chain is an important consideration, as platform-based approaches can facilitate the integration of sustainable practices and environmentally friendly solutions throughout the construction process.

- Lastly, platforms promote the democratisation of design, providing opportunities for increased collaboration, innovation, and access to design resources and expertise.
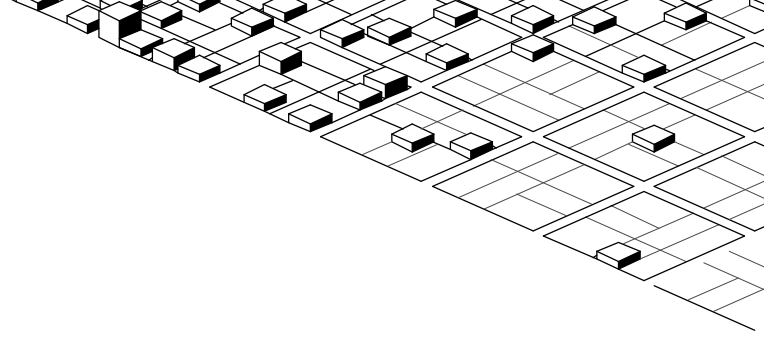
CHALLENGES

The platform ecosystem approach to building is relatively new in the Australian building industry, leading to scepticism regarding its successful application in the traditional building sector.

CULTURAL CHANGE, RE/UP-SKILLING, TECH ADOPTION

First, much-needed cultural change, lack of skilled workers, and slow technology adoption. This highlighted the need for a shift in organisational mindset, the availability of skilled personnel, and the adoption of technology at a faster pace.

DATA, ROLES, AND RISK UNCERTAINTY

Second, uncertainty related to data management, roles and responsibilities, and the transfer of risk in the context of platform ecosystems. Participants expressed concerns about effectively managing and sharing data, defining clear roles and responsibilities, and mitigating risks associated with collaborative platforms.

SUPPLY CHAIN CAPACITY

Third, limited supply chain capacity. Participants emphasised the need to ensure that the traditional supply chain is equipped to meet the demands of the platform ecosystem model.

TRADITIONAL ROI, HIGH CAPEX

Lastly, the rigid return on investment (ROI) models and high capital expenditure (capex) requirements may hinder the adoption of a platform ecosystem business model.

"As a project management consultant, I see conflicts between stakeholders and digital adoption as the most important challenge."

"I am a structural provider, and my key challenges are managing delivery and design risk when contingent on the performance of others."

Traditional ROI, high capex

15.00%

Cultural change,
re/up-skilling, tech adoption

33.57%

Supply chain capacity

18.57%

Challenges

32.86%

Data, roles, and risk uncertainty
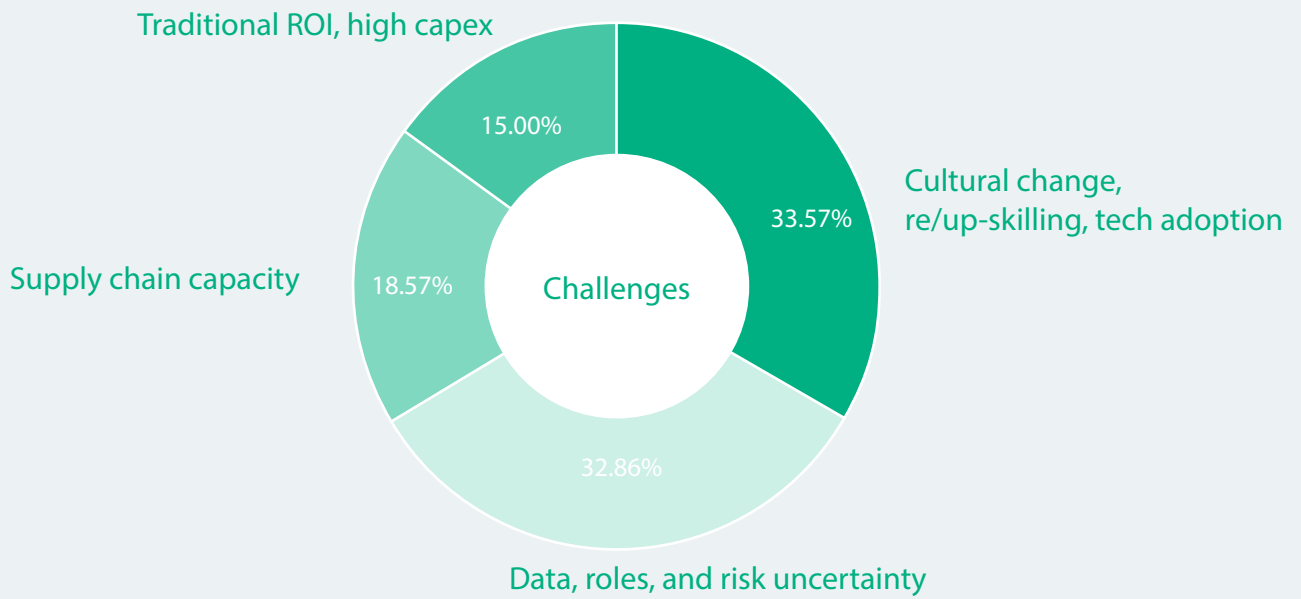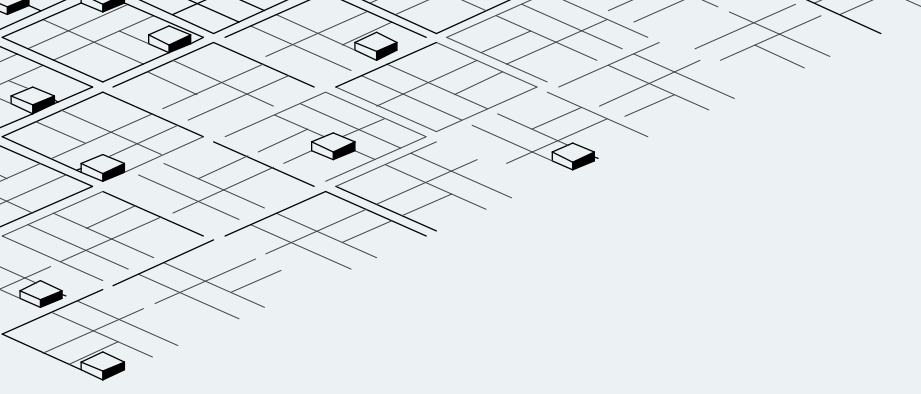
OTHER ASSOCIATED CHALLENGES

- There is uncertainty around the interoperability of existing manufactured products with the platform ecosystem.

- No legal framework can effectively accommodate this approach, and there are difficulties with conflict resolution, arbitration, and risk distribution.

- The lack of exemplars and industry-level plans of action further hinder the adoption of platform ecosystems.

- The absence of a capital investment strategy to support the future pipeline of work within the platform ecosystem model adds to the challenges.

These challenges emphasise the need for comprehensive industry-wide efforts to address legal, operational, and strategic aspects, thereby facilitating a successful transition to the platform ecosystem model in the building industry.

KEY CHANGES REQUIRED FROM STAKEHOLDERS

BREAKING DOWN INFORMATION SILOS

Stakeholders recognise the need to break down information silos, which hinder effective communication and collaboration. By fostering a culture of openness and knowledge sharing, the industry can overcome barriers and enable the seamless flow of information across various entities.

SYMBIOTIC AND LONG-TERM RELATIONSHIPS

Additionally, nurturing strategic and symbiotic relationships between different stakeholders is crucial for driving the platform ecosystem business model and achieving mutual benefits. This involves establishing partnerships and alliances that foster collaboration, trust, and shared goals.

CHANGE IN TRADITIONAL PROCUREMENT

There is a growing realisation of the need to change traditional procurement models. The industry needs to adopt alternative approaches that promote early engagement, integration, and shared risks and rewards, aiming to optimise project outcomes and enhance overall efficiency.

"I'm an architect, and new ways of transferring design information are required beyond 'BIM'; new supports for collaboration and iteration of design that can handle inputs from up and downstream together. "

"I am the logistics provider, and I will need deeper insights into the detailed working of the project to fulfil my role."

Change in traditional procurement — 28.89%

Breaking down information silos — 37.78%

Symbiotic and long-term relationships — 33.33%
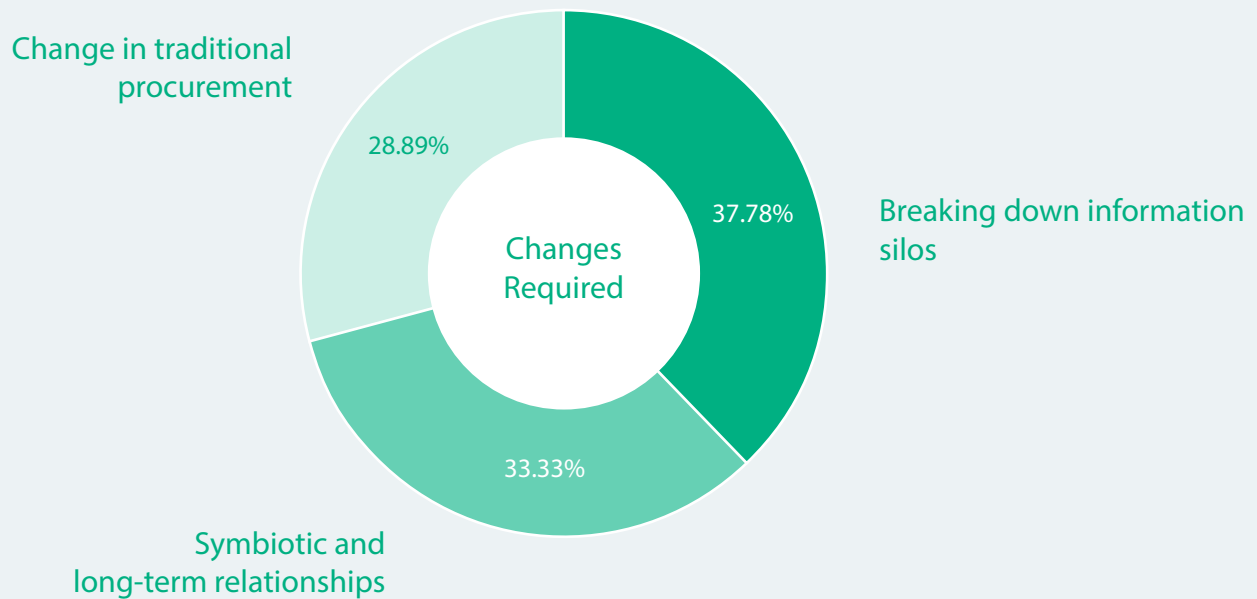
Changes Required

OTHER ASSOCIATED CHANGES REQUIRED

- Upskill and retrain the workforce to adapt to the changing demands of the platform ecosystem. With the emergence of new technologies and methodologies, continuous learning and development are essential for employees to remain competitive and proficient in their roles.

- Additionally, there is a growing need to invent new capital investment models that align with the platform-based approach, as traditional financing structures may not fully support the unique characteristics of this ecosystem.

- Shifting perspectives from short-term gains to long-term value creation is also vital, as the platform ecosystem encourages a more holistic and sustainable approach to business. This transition requires transparency and collaboration among all participants to ensure mutual success and shared outcomes.

- Lastly, considerations regarding authorship over design inputs and the development of new reward structures are being discussed, as the platform ecosystem challenges traditional notions of ownership and encourages new ways of thinking and collaboration.

READINESS OF THE AUSTRALIAN BUILDING ECOSYSTEM

The rise and fall of the US company Katerra has changed the narrative around the viability of a vertically integrated platform business model in building. Having raised over $2 billion, the sheer volume of capital expenditure proved to be detrimental rather than beneficial. The building industry is risk-averse and always a 'third' or 'fourth' adopter. Katerra shifted the focus from the general perception that 'the industry can transform with an increased capital investment' to the perception that 'the industry can transform only with viable business models'.

The workshops produced exemplars of all three super-patterns of Industry 4.0 business model innovation.

01
INTEGRATION

"I am a prefab manufacturer, and I can be involved at a design level as early as possible in a project lifecycle to provide constructability input…"

"I am a modular builder and I can assemble a complete value chain and bid for a complete package rather than small elements…."

…opportunity to move value adding activities upstream; which is an exemplar of integration.

02
SERVITISATION

"I am a steel manufacturer and supplier, and I can bundle value-added elements for example, I can embed digital services for condition monitoring…

…real-time sensor data, simulation and data analytics, condition monitoring, predictive maintenance, and preventive maintenance exemplify value creation in industrialised-digitalised business models.

03
EXPERTISATION

"I am an architect and I can pivot to the design of systems and not buildings using parametric and generative design tools; I can then directly engage with the supply chain during design instead of traditional linear additive procurement. I can design smarter and cleaner as part of an ecosystem led by multiple agendas…."

…………design value holds the key to accessing untapped markets, ensuring responsible design, and enhancing cost-effectiveness. This value not only brings about tangible business advantages, but also enriches the wider social, cultural, and economic aspects of a building.
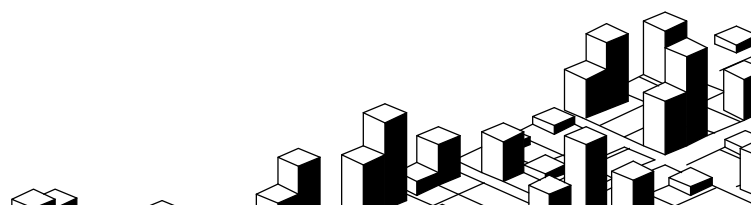
THE CONCERNS

The developers, clients, and contractors may face the most significant disruption with the shift to a platform ecosystem business model with concerns around contractual arrangements, risk distribution, and upskilling. Stakeholders that are downstream might be in a position of advantage, however, concerns around interoperability of their product remain.

Interoperability	"I am a bathpod manufacturer and I don't know if my products will be compatible with the platform…"
IP and data liabilities	"I am a contractor and now I have more data, risk, and exchanges occurring across the ecosystem…"
Cultural barriers	"I am a modular builder, and it is a challenge to convince all stakeholders to collaborate and initiate a cultural shift in the industry…"
Contractual arrangements	"Even though stakeholder groups have the ability to involve from the moment of inception to create better value for the client, the current rigid procurement model and contractual arrangements do not allow for such innovation to occur."
Skill deficit	"I am a contractor, and my challenge is keeping up with the changing perceptions within the business and building the skills to deliver prefab projects…"
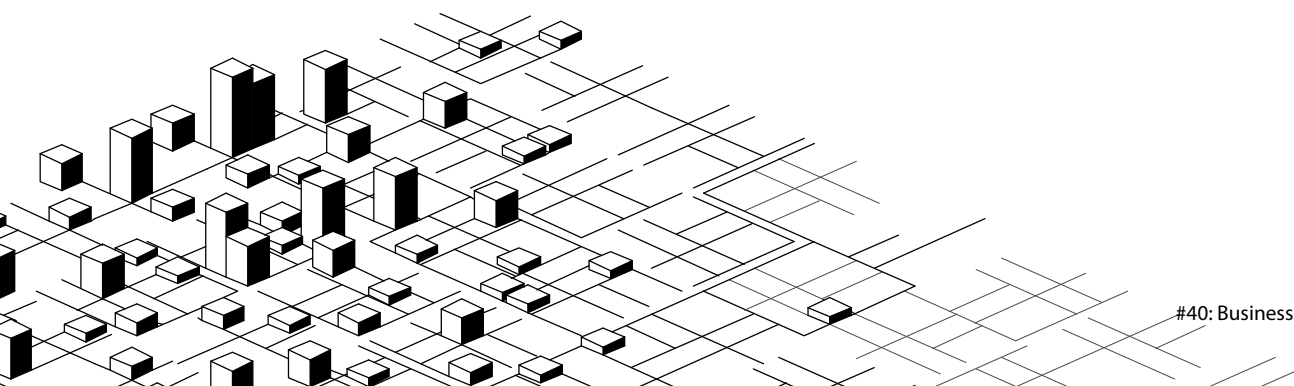
THE ECOSYSTEM READINESS FRAMEWORK

The workshop inputs were further analysed by mapping them to existing frameworks in the literature to understand the current status of business model innovation in the Australian building ecosystem. Dynamic capabilities represent an organisation's capacity to rapidly adapt, innovate, and fine-tune its business models in response to changing market conditions and organisational needs. A set of dynamic capabilities is required for each stage of the ecosystem lifecycle.
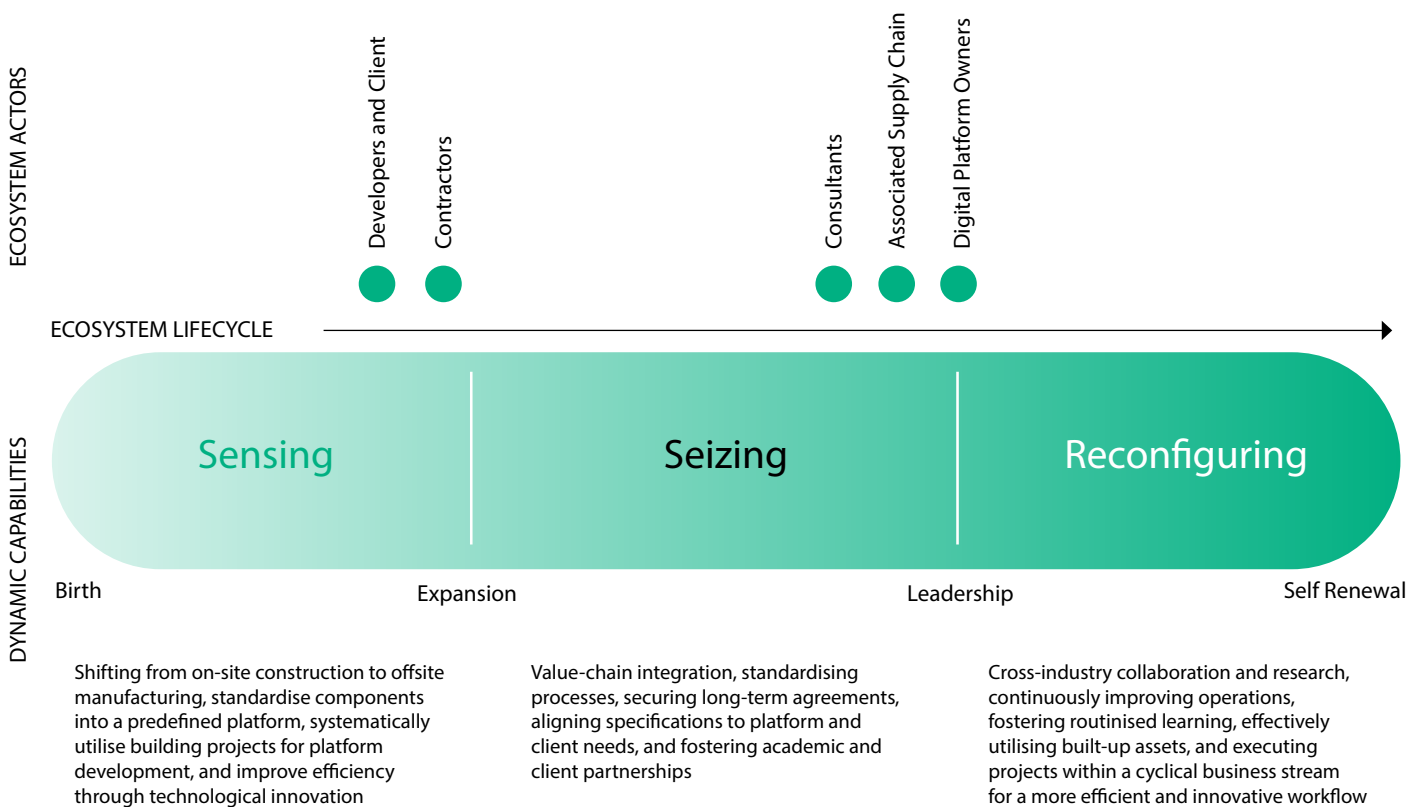
The Ecosystem Readiness Framework

- As illustrated, developers, clients and contractors are actively sensing opportunities and moving into the expansion stage of the ecosystem lifecycle.

- Consultants have the capability within their businesses to guide this ecosystem in terms of 'design value' and 'project management'.

-

- Associated supply chain actors such as prefab manufacturers, material manufacturers and suppliers, and modular builders are already seizing business model innovation opportunities through value chain integrations and servitisation business models.

- Slightly ahead in the trajectory are some of the digital platform owners that are already reconfiguring through multi-sided marketplaces.

"I am a project management consultant who can curate a team of like-minded businesses/producers on a project. I can bring the client, design team, builders, and subcontractors together to work towards the best outcomes for all involved…"

TOP 5 RECOMMENDATIONS FOR KEY SECTORS

GOVERNMENT

PRIORITISE INNOVATION THAT SUPPORTS TRANSFORMATIVE PRACTICES
Integrate systematic innovation into procurement processes and industry policies.

DEVELOP COOPORATIVE CONTRACTUAL FRAMEWORKS
Incentivise transitioning from adversarial contracts towards mutually cooperative frameworks within contractural agreements.

ESTABLISH PRODUCTIVITY MEASURES & BENCHMARKS FOR THE BUILDING SECTOR
Incentivise new technologies and processes that enhance productivity.

EXPAND THE PURVIEW OF THE NATIONAL RECONSTRUCTION FUND
Include industraliased building in the National Reconstruction Fund to create a market for this new way of building.

CREATE MECHANISMS FOR FINANCIAL RESILIENCE WITHIN THE BUILDING INDUSTRY
Collaborate with industry stakeholders to address the issue of rising insolvency rates.

INDUSTRY

CREATE AN ECOSYSTEM THROUGH NOVEL PARTNERSHIP AGREEMENTS
Facilitate a dynamic marketplace for the supply chain to contribue with low barriers of entry.

BUILD DIGITAL AND PROCEDURAL CAPACITY THROUGHOUT THE SUPPLY CHAIN
Enable continuous improvement using seamless communication and data-driven insights.

INVEST IN R&D TO TEST THE PLATFORM ECOSYSTEM MODEL ON REAL PROJECTS
Collaborate with academia to understand the challenges and pass them on to the peak industry bodies/government for regulatory/policy change advocacy.

INTEGRATE PLATFORM DNA INTO EXISTING SUITES OF PRODUCTS OFFERED BY THE ASSOCIATED SUPPLY CHAIN
Invest in upskilling of a platform champion and the promotion of circular products.

UPSKILL THE TRADITIONAL SUPPLY CHAIN TO BE PLATFORM-READY
Establish a framework for regular digital literacy training of the traditional supply chain actors.

RESEARCH & EDUCATION

INTEGRATE 'PREFAB' INTO THE CURRICULUM
Develop 'prefab' bachelor's degrees, VET level programs, and new Masters-level degrees for the future built environment professional and post-professional qualifications.

FUNDRAISE FOR LARGE-FORMAT & COLLABORATIVE DEMONSTRATION PROJECTS
Collaborate with the industry to execute lighthouse projects demonstrating the platform ecosystem business model leveraging joint data analysis and learning.

FOCUS FUTURE RESEARCH ON COOPERATIVE CONTRACTUAL FRAMEWORKS
Develop contractual frameworks that will enable the risk distribution dynamics between the ecosystem actors.
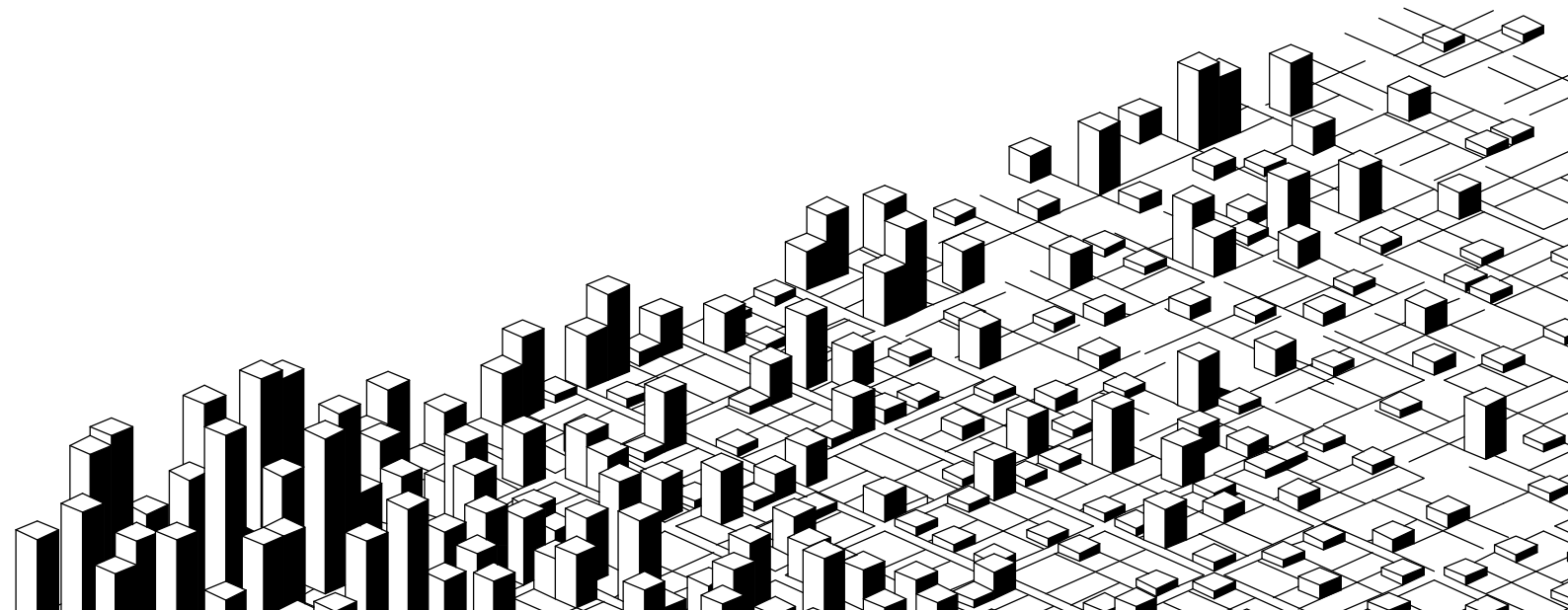
EXPLORE AVENUES OF OVERLAP BETWEEN PLATFORMS AND DIGITAL TWINS
Delineate the terminologies and understand how emerging technologies such as Web3 might impact platforms and digital twins.
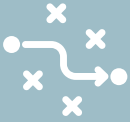
EVALUATE HOW PLATFORMS CAN ENABLE A HUMAN-CENTRIC APPROACH
Understand how platforms will evolve with the shift from Industry 4.0 to 5.0.

PEAK INDUSTRY BODIES

DEVELOP INDUSTRY LEVEL ACTION PLANS

Ensure involvement of the legacy players and dissenting voices in developing industry-level action plans.

ESTABLISH AN ANNUAL WORKSHOP SERIES OR INDUSTRY REVIEW

Ensure the action plan is not merely a theoretical exercise but is actively monitored to track progress and drive meaningful advancements within the industry.

DEVELOP COMPREHENSIVE ACCREDITATION SYSTEMS LIKE THE BOPAS

Collaborate with relevant stakeholders, including manufacturers, designers, and regulatory authorities, to develop comprehensive accreditation systems.

ADVOCATE INDUSTRIALISED BUILDING IN A HOLISTIC MANNER

Focus less on the product and more on processes in advocating industralised building, including contracts, investment structures, and decarbonisation.

GATHER, USE, AND PROMOTE DATA

Collaborate with the government and industry stakeholders for joint data acquisition and analysis. relevant to industrialised building.

APPENDICES

THE 'INTEGRATED PRODUCT' PERSPECTIVE

Intelligent City is a technology-driven company that offers seamless and transparent design to deliver of mass timber housing solutions.

Founded in 2008

Vancouver

Intelligent City

STRATEGIC DEFINITION — PREPARATION AND BRIEFING — DESIGN & ENGINEERING — SUPPLY & MANUFACTURING — SITE ASSEMBLY & COMMISSIONING — OPERATE / MAINTAIN / EVOLVE

"Intelligent City Raises $30 million to Advance the Sustainable Urban Housing Industry Using Mass Timber, Automation, and Robotics."

ORIGIN STORY

Intelligent City was founded to create highly integrated and generative mixed-use housing systems combining high-quality liveability, enhanced affordability, advanced sustainability, and community engagement into one consistent, replicable, and adaptable solution.

VALUE PROPOSITION

- Certainty of cost and time
- Variability in design options
- Quality-assured, durable buildings that retain value
- Inherent fire and seismic safety
- Post completion support with data intelligence

PRODUCTS AND SERVICES

- Consultation and Preliminary Design
- Parametric Design
- Manufacturing and Automated Assembly

CUSTOMER SEGMENTS

- Developers
- Private Owners
- Housing Agencies
- Non-profit Societies

TECHNOLOGY

A proprietary end-to-end design process powered by Platforms for Life that encodes the relationship between parameters and design response with innovative algorithms
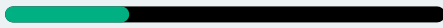
PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

CIRCULARITY

THE 'COMPLETE PLATFORM-ISATION' PERSPECTIVE

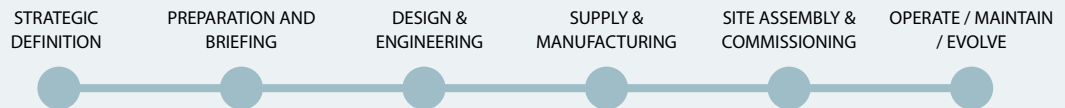**Founded in 2015**
Shut down in 2021

California

Katerra was a vertical integration-driven start-up that aimed to offer end-to-end solutions using a single platform with a continuous data stream from planning to operation.

KATERRA

STRATEGIC DEFINITION — PREPARATION AND BRIEFING — DESIGN & ENGINEERING — SUPPLY & MANUFACTURING — SITE ASSEMBLY & COMMISSIONING — OPERATE / MAINTAIN / EVOLVE

"*Katerra's insolvency concluded the most well-funded attempt to redefine the AEC industries through modular design, prefabrication, and supply-chain integration.*"

ORIGIN STORY

Katerra was a start-up backed by Silicon Valley venture capital whose first incarnation was more of a supply and logistics company, but later, the value proposition became 'vertical integration'. They adopted a growth-by-acquisition strategy and peaked at 8500 employees across the globe.

The founders had experience with the likes of Tesla and Autodesk.

VALUE PROPOSITION

"Katerra is a new kind of company in the building industry, delivering a comprehensive suite of products and services for our clients. This offering is possible because of Katerra's distinct model, which combines end-to-end integration with significant investment in technological and design innovation" - Sourced from Katerra's then website.

PRODUCTS AND SERVICES

• Building Platform

• Structural Systems | Utility Systems

• Window Products | Finish Materials | Manufactured Assemblies

• Software

CUSTOMER SEGMENTS

• Multi-family

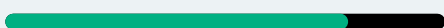• Student and Senior Housing

TECHNOLOGY

Katerra Apollo - A single platform with one continuous data stream from planning to operation
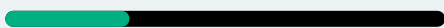
PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

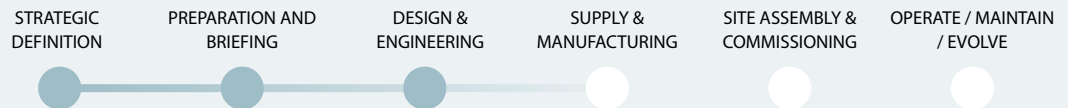CIRCULARITY

THE 'DISTRIBUTED PROJECT' PERSPECTIVE

Bryden Wood is a global consultant to the platform approach. They have been involved in P-DfMA projects with major contractors.

Founded in 1995

London

Bryden Wood

STRATEGIC DEFINITION	PREPARATION AND BRIEFING	DESIGN & ENGINEERING	SUPPLY & MANUFACTURING	SITE ASSEMBLY & COMMISSIONING	OPERATE / MAINTAIN / EVOLVE

"In 2019 Landsec and Bryden Wood partnered with product prototype and development company Easi Space for the Forge, the world's first major commercial building to be designed and built using a platforms approach."

ORIGIN STORY

Bryden Wood is a global company of creative technologists, designers, architects, engineers, and analysts. They are leaders in the theory and practice of Modern Methods of Construction (MMC), the Platform approach to Design for Manufacture and Assembly (P-DfMA), generative design, creative technologies, integrated design, and automation in construction.

VALUE PROPOSITION

- Net Zero
- Safer construction
- Retain creative design freedom
- More efficient and higher productivity

PRODUCTS AND SERVICES

- Platforms (P-DfMA) | Chip Thinking®
- Apps and configurators – Example PRiSM
- Building physics
- Systemisation

CUSTOMER SEGMENTS

- Multi-family, Student and Senior Housing
- Commercial (Offices, Hospitals, Factories)
- Data Centres, Prisons

TECHNOLOGY

A combination of typical construction software (Revit, Tekla) and platform-specific routines (in Grasshopper and Dynamo)

PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

CIRCULARITY

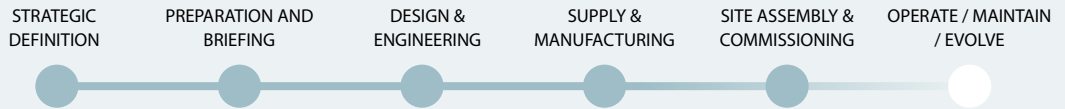# THE 'INDUSTRIALISED CONSTRUCTION CONSULTANT' PERSPECTIVE

Project Frog is streamlining the design and construction processes with a scalable digital platform that can be inserted anywhere along the build process.

Founded in 2006

San Francisco

| STRATEGIC DEFINITION | PREPARATION AND BRIEFING | DESIGN & ENGINEERING | SUPPLY & MANUFACTURING | SITE ASSEMBLY & COMMISSIONING | OPERATE / MAINTAIN / EVOLVE |

"KitConnect is an integrated Revit to web application built on Forge, which includes a Revit plug-in and a web application, centralising data in the cloud and enabling easy project scaling."

ORIGIN STORY

For over 15 years, Project Frog's team of architects, engineers, supply chain managers, and field experts has been working towards a mission of eliminating the chaos of design and construction.

Project Frog offers a holistic approach to productising buildings from design to occupancy using their digital platform.

VALUE PROPOSITION

- Project Frog Fit - A predictable and repeatable building program that captures the speed of offsite construction while ensuring brand compliance

- Project Frog Flex - Standard kit-of-parts

- KitConnect - BIM productisation by offering a framework for repeatability, consistency, and scalability of building design

PRODUCTS AND SERVICES

- Project Frog Fit (Retail)

- Project Frog Flex (Healthcare, Education)

- KitConnect (SaaS)

- LANTANA, Architectural Lighting Solutions

CUSTOMER SEGMENTS

- Owners & Developers (Retail, Education and Healthcare)

- KitConnect - Owners & Developers, Prefab Manufacturers, Design Firms and Builders & General Contractors

TECHNOLOGY

Bringing assembly logic to BIM KitConnect to help Building Owners, Designers, and Product Creators bridge the digital divide to accurately and efficiently share Product-to-Project design data.

PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

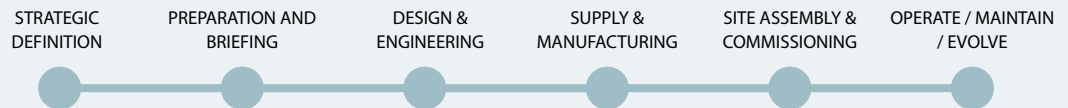CIRCULARITY

THE 'MARKETPLACE' PERSPECTIVE

PT Blink offers a digital platform that enables the parametric design of multi-storey buildings as a kit of configurable parts and then provides a marketplace for direct dealing between buyers and sellers.

Founded in 2016

Sydney

ptblink
DESIGN
MANUFACTURE
INTEGRATE

STRATEGIC DEFINITION — PREPARATION AND BRIEFING — DESIGN & ENGINEERING — SUPPLY & MANUFACTURING — SITE ASSEMBLY & COMMISSIONING — OPERATE / MAINTAIN / EVOLVE

"Local construction tech start-up PT Blink has raised $5 million from the owners of US-based multi-billion dollar real estate investmen t company Holland Partner Group."

ORIGIN STORY

With PT Blink's digital platform, owners and developers can deliver multi-storey buildings as a kit of configurable parts manufactured offsite and integrated very quickly and safely onsite by ecosystem partners.

They consider themselves a software development company now, but they evolved from a construction background in the 1990s.

VALUE PROPOSITION

- Customised components for any design

- Enables complete dimensional accuracy

- Open manufacturer marketplace

- Speed to market for developers

- Better outcomes for property owners

PRODUCTS AND SERVICES

- Parametric interface and components

- An open marketplace enables direct dealing between buyers and sellers

CUSTOMER SEGMENTS

- Developers & Owners

- For partners (such as manufacturers), the ecosystem serves as a growing pool of opportunity for new business and collaboration

TECHNOLOGY

Powered by a proprietary Blink DMI™ Cube parametric interface and design tool, Blink DMI™ platform connects and coordinates all members of ecosystem throughout a project

PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

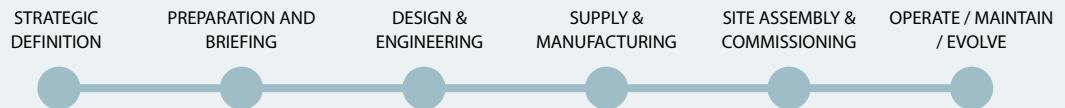CIRCULARITY

THE 'SIMPLIFIED HOMEOWNERSHIP' PERSPECTIVE

Nabr treats buildings as products, not projects, simplifying the home-buying experience with a B2C offering where you start with something as simple as creating a profile.

Founded in 2021

New York

nabr

| STRATEGIC DEFINITION | PREPARATION AND BRIEFING | DESIGN & ENGINEERING | SUPPLY & MANUFACTURING | SITE ASSEMBLY & COMMISSIONING | OPERATE / MAINTAIN / EVOLVE |

"Nabr, a direct-to-consumer housing start-up, raises $48 million to Build the Future of Urban Living."

ORIGIN STORY

Co-founded by Bjarke Ingels (founder of architectural firm Bjarke Ingels Group), Roni Bahar (formerly of WeWork), and Nick Chim (co-founder of Flux, a spinout of Google[x]), Nabr launched to the public in December 2021, offering the opportunity to join a waitlist for its future developments.

Nabr is a people-first housing company.

VALUE PROPOSITION

- Delivering an empowering and transparent experience for home buyers

- Buyers always have a direct point of contact rendering the home-buying process straightforward

- All homes begin with the Nabr design. Buyers can browse curated design packages and upgrades to make their space feel personal.

- Three payment options: all-cash, mortgage (with a down payment), or LEAP, lease-to-purchase program

PRODUCTS AND SERVICES

- Nabr's Design Studio | Modular Interiors

- Nabr App | Carrier-Grade Wi-Fi

- Digital Twin of Your Home

CUSTOMER SEGMENTS

- Home Buyer

TECHNOLOGY

NABR's design studio, including a payment platform that forms the core of their operation

PLATFORM ATTRIBUTES

CONFIGURABILITY

INTEROPERABILITY

OPENNESS

CIRCULARITY

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